805

- Use algebraic manipulations to simplify the
- $\overline{AB} \overline{AB} + \overline{AB} + \overline{AB}$
- Use algebraic manipulations to show that usive-NOR operation has the equivalent
  - $B = (A + \overline{B})(\overline{A} + B) = AB + \overline{A}\overline{B}$
- Use algebraic manipulations to show that
  - $\oplus B = A\overline{B} + \overline{A}B = (A + B)(\overline{AB})$
- Use algebraic manipulations to show that
  - $-\overline{A}\overline{C} = (\overline{A} + B)(A + \overline{C})$
- Find the dual of the expression given in (a) 11.33, (b) Problem 11.34, (c) Problem 11.36, and (e) Problem 11.37.
- Use algebraic manipulations to show that is clusive-OR operation  $A \oplus B = A\overline{B} + \overline{A}B$  is immutative, that is,  $A \oplus B = B \oplus A$ ; (b) assothat is,  $A \oplus (B \oplus C) = (A \oplus B) \oplus C$ .
- Use algebraic manipulations to show that exclusive-NOR operation  $A \odot B = AB + \overline{AB}$  is mutuative, that is,  $A \odot B = B \odot A$ ; and (b) entire, that is,  $A \odot (B \odot C) = (A \odot B) \odot C$ .
- Show that (a)  $A \uparrow B = B \uparrow A$ , and  $\uparrow (B \uparrow C) \neq (A \uparrow B) \uparrow C$ , where  $\uparrow$  denotes the D operation.
- Construct a truth table for the function  $F_1 = B \uparrow C$ ), where  $\uparrow$  denotes the NAND operation. Seess  $F_1$  as (a) a sum of minterms, and (b) a prodmaxterms. Repeat for  $F_2 = (A \uparrow B) \uparrow C$ .
- NAND gates, and (b) NOR gates. Repeat for an usive-NOR gate.
- A majority gate is a logic circuit whose that is 1 when a majority (more than half) of its are 1. Construct the truth table for a three-truth majority logic gate. Express the Boolean function of the gate as (a) a

- sum of minterms, and (b) a product of maxterms. Realize both of these expressions using AND gates and OR gates.
- 11.45 Show that the Boolean function F = AB + BC + AC describes the output of a three-input majority gate (see Problem 11.44) by constructing the corresponding truth table. Implement this function with a two-level logic circuit employing only NAND gates.
- **11.46** Show that the Boolean function F = (A + B)(B + C)(A + C) describes the output of a three-input majority gate (see Problem 11.44) by constructing the corresponding truth table. Implement this function with a two-level logic circuit employing only NOR gates.
- 11.47 Express the Boolean function F = A + BC as (a) a sum of minterms, and (b) a product of maxterms. Realize the expression obtained in part (a), the expression obtained in part (b), and the expression F = A + BC by using AND gates and OR gates. Which realization requires the fewest logic gates?
- 11.48 Implement the Boolean function F = A + BC = (A + B)(A + C) with a two-level logic circuit employing only (a) NAND gates, and (b) NOR gates.
- 11.49 Use algebraic manipulations to express the Boolean function F = AB + BC + AC as (a) a sum of minterms, and (b) a product of maxterms.
- 11.50 Use algebraic manipulations to express the Boolean function  $F = \overline{A}\overline{B} + B\overline{C}$  as (a) a sum of minterms, and (b) a product of maxterms.
- 11.51 Find the simplified sum-of-products form of the Boolean functions: (a)  $\overline{A}\overline{B}C + \overline{A}\overline{B}\overline{C} + A\overline{B}\overline{C} + A\overline{B}C + \overline{A}\overline{B}C + \overline{A}\overline{B}C + \overline{A}\overline{B}C + A\overline{B}C + A\overline{B}C + ABC$ , (b)  $\overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}\overline{B}C + ABC$ , and (d)  $\overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}\overline{B}C + \overline{A}\overline{B}\overline{C} + AB\overline{C}$ .
- 11.52 Find the simplified product-of-sums forms of the Boolean functions given in Problem 11.51.
- 11.53 Find the simplified sum-of-products forms of the Boolean functions that correspond to the Karnaugh maps shown in Fig. P11.53.

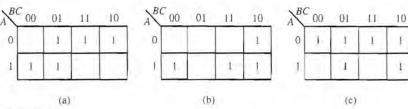


Fig. P11.53

- 11.54 Find the simplified product-of-sums forms of the Boolean functions corresponding to the Karnaugh maps given in Fig. P11.53.
- **11.55** Find the simplified product-of-sums form of the Boolean functions:

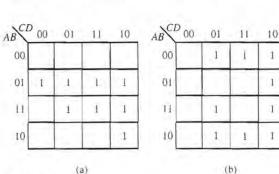
(a) 
$$(A + B + C)(A + B + \overline{C})(A + \overline{B} + \overline{C})$$
  
 $(\overline{A} + B + \overline{C})(\overline{A} + \overline{B} + \overline{C})$ 

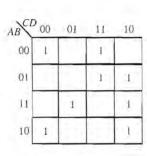
(b) 
$$(A + B + \overline{C})(A + \overline{B} + \overline{C})(A + \overline{B} + C)$$

(c) 
$$(A + B + \overline{C})(\overline{A} + B + \overline{C})(\overline{A} + \overline{B} + C)$$
  
 $(\overline{A} + \overline{B} + \overline{C})$ 

**11.56** Find the simplified sum-of-products forms of the Boolean functions given in Problem 11.55.

- 11.57 Find the simplified sum-of-products for of the Boolean functions that correspond to the kanaugh maps shown in Fig. P11.57.
- **11.58** Find the simplified product-of-sums for of the Boolean functions corresponding to the Ranaugh maps given in Fig. P11.57.
- **11.59** Find the simplified sum-of-products of the Boolean functions (a)  $\overline{A}(\overline{B} + \overline{C}) + \overline{A}B \overline{B}$  (b)  $A(B + \overline{D}) + \overline{B}(C + AD)$ , and (c)  $\overline{B}D + \overline{A}B\overline{C} + A(\overline{B}C + B\overline{C})$ .





(c)

Fig. P11.57